

# Post T Tauri and young main sequence stars in the solar neighborhood: isolated or members of young stellar kinematic groups



D. Montes<sup>1</sup>, J. López-Santiago<sup>1</sup>, R.M. Martínez-Arnáiz<sup>1</sup>  
 P. Guillout<sup>2</sup>, A. Klutsch<sup>2</sup>, R. Freire Ferrero<sup>2</sup>, A. Frasca<sup>3</sup>, E. Marilli<sup>3</sup>

<sup>1</sup> Universidad Complutense de Madrid, Dpt. de Astrofísica, Madrid, Spain,

<sup>2</sup> Observatoire Astronomique de Strasbourg, France

<sup>3</sup> Osservatorio Astrofisico di Catania, INAF, Italy



## Abstract

Post T Tauri stars (PTTS) and young main sequence stars (YMS) are late-type stars (K/M and F/G respectively) in the age range between 10 and 100 Myr filling the gap between T Tauri (or Fe/Ge pre-main sequence) and zero-age mainsequence phases. This period of evolution remains ambiguous and until now different studies of young stars have failed to find the numbers of PTTS and YMS that are expected. In the last years some PTTS and YMS have been identified among the X-ray detected pre-main sequence stars in some star-forming regions. More recently, additional candidates have been identified in young associations and moving groups ( $\beta$  Pic, TW Hya, Tucana/Horologium, and the AB Dor). However, many isolated PTTS and YMS still remain undiscovered. In this contribution, we compiled the PTTS and YMS previously identified in the literature, and identified new candidates using the information provided by the high resolution spectra obtained during our surveys of late-type stars possible members to young moving groups (Montes et al. 2001b, López-Santiago, et al. 2005, 2006), FGK stars in the solar neighborhood (Martínez-Arnáiz et al. 2008), and stars in the RasTyc sample (cross-correlation of the ROSAT All-Sky Survey (RASS) with the TYCHO catalog, Guillout et al. 2008). To identify PTTS we applied an age-oriented definition using relative age indicators (Lithium abundance, chromospheric emission and kinematics) as well as color-magnitude diagrams and pre-main sequence isochrones.

## Observations

High resolution spectroscopic observations have been taken during several observing runs in La Palma and Calar Alto observatories from 1999 to 2004 during our spectroscopic survey of possible members of young moving groups. Additional spectra from some southern stars have been taken with the ESO 2.2m telescope using FEROS spectrograph. In addition, since 2005 we are observing FGK stars in the solar neighbourhood ( $d < 25$  pc) mainly with FOCES/2.2m and SARG/TNG spectrographs. Spectra of the RasTyc sample have been obtained at OHP (Observatoire de Haute Provence), TNG, and OAC (Osservatorio Astrofisico di Catania). The obtained spectra have spectral resolution around 40000 – 50000 and cover a spectral range from 3500 to 9000 Å, from the Ca II H & K (3933, 3968 Å) to the Ca II IRT (8498, 8542, 8662 Å) lines. Reference stars of similar spectral type and radial velocity standard stars have also been observed with the same configuration.

## Selection from the Lithium (Age)

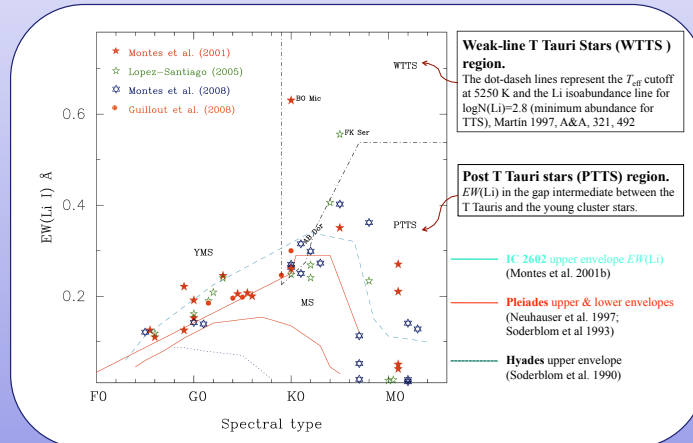


Fig. 1: Equivalent width of the Li I line at 6707.8 Å as a function of spectral type for the selected stars, compared with the envelopes of well-known stellar clusters (ages from 10 to 600 Myr).

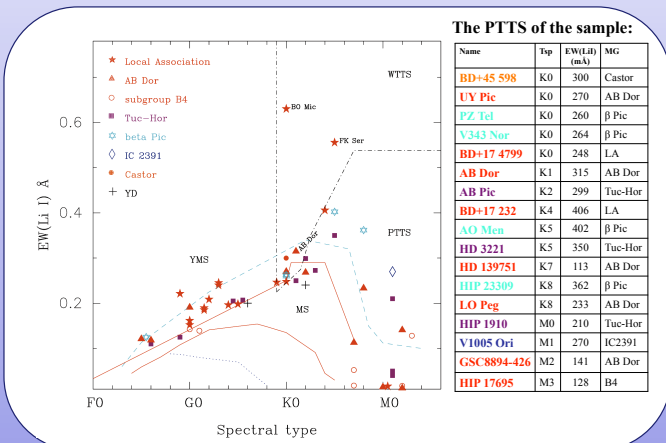


Fig. 2: As Fig. 1 but in this case different symbols are used to identify the stars members of the Local Association, AB Dor moving group, and B4 subgroup (see López-Santiago et al. 2006), IC2391 and Castor moving groups (Montes et al. 2001a) and  $\beta$  Pic and Tuc-Hor associations (Zuckerman & Song 2004).

The possible Post Tauri stars (PTTS) and young stars analysed in this contribution have been selected from our catalog of late-type stars (F to M) members of young stellar kinematic groups (Montes et al. 2001a, MNRAS, 348, 45) and the RasTyc sample (Guillout et al. 1999, A&A, 351, 1003; 2008). A large number of these stars have been observed by us during the last years with high resolution spectroscopy (Montes et al. 2001b, A&A, 379, 976; López-Santiago 2005, PhD Thesis UCM; López-Santiago et al. 2006, ApJ, 643, 1160; Montes et al. 2008, CS14; Klutsch et al. 2008, CS14; Guillout et al. 2008).

Using the equivalent width of the Li I line at 6707.8 Å,  $EW(\text{Li I})$ , determined by us plus additional values taken from the literature we have selected the stars with  $EW(\text{Li I})$  above the upper envelope of the Pleiades open cluster (78 Myr), see Figs. 1 and 2. The membership to young moving groups like the Local Association, AB Dor,  $\beta$  Pic and Tuc-Hor is indicated in Fig. 2 with different symbols (see also the  $U, V$  diagram in Fig. 4).

## Spectra of some $\beta$ Pic Moving Group members

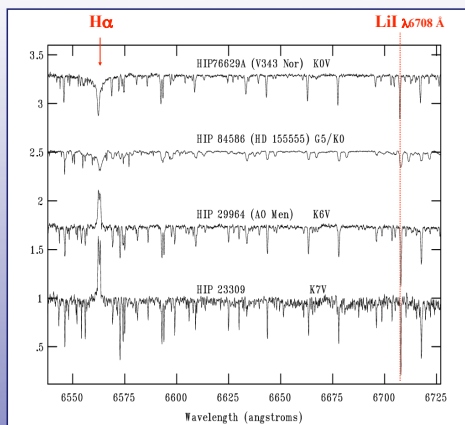


Fig. 3: High resolution spectra of possible members of the  $\beta$  Pic moving group in the  $H\alpha$  and Li I  $\lambda 6708$  Å line region. Note the intense  $H\alpha$  emission of AO Men and HIP 23309. HD 155555 is a SB2 system and the Li I line from both components is detected.

Here we show some representative spectra of one young stellar kinematic group, the  $\beta$  Pic association.

## Kinematics of the possible PTTS and YMS

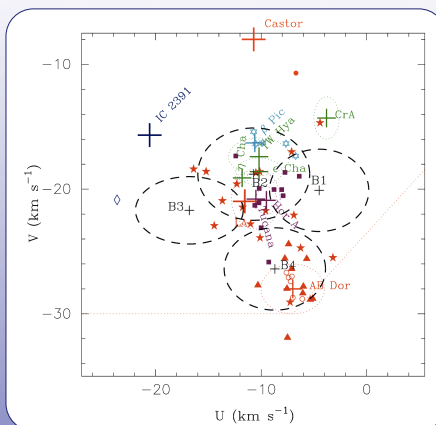


Fig. 4: Position in the  $(U, V)$ -plane of the stars selected as possible PTTS and YMS.

The kinematics (galactic space velocity components,  $U, V$ ) indicate that the whole selected stars are in the region of the young disk stars and very close to the position of the Local Association and other very young stellar associations and moving groups like AB Dor, subgroup B4 of the Local Association,  $\beta$  Pic, Tuc-Hor, IC 2391 and Castor (Montes et al. 2001; López-Santiago et al. 2006; Torres et al. 2008).

## Additional FGK stars ( $d < 25$ pc)

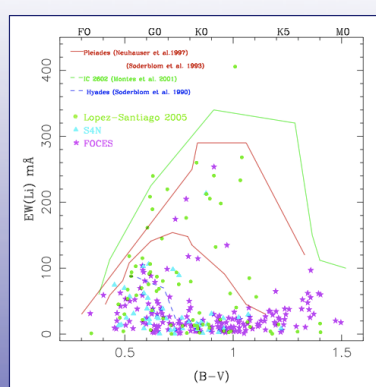


Fig. 5: As Fig. 1, for the stars in our recent survey of FGK stars in the solar neighbourhood ( $d < 25$  pc), see Martínez-Arnáiz et al. and Maldonado et al. posters. We identify additional stars with ages between those of the Pleiades and the Hyades, but any new PTTS.

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